**Objectives**

* Indentify types of energy and energy transformations associated with movement and/or change of matter.

**Causal Principles**

1. Gravitational energy, thermal energy and/or chemical **energy** drive all movement and change of matter on Earth.

2. A system is in **equilibrium** when energy in the system is balanced.

4. **Energy** is needed to break bonds and is released when bonds form.

5. **Temperature** is a measure of the movement of molecules. Higher temperature means molecules are moving faster.

**PART 1: Background Notes**

Types of energy:

Two main categories:

*Kinetic energy*: The energy a body has due to its movement.

*Potential energy*: The energy stored in a body due to its position or arrangement of its parts. Potential energy is converted into kinetic energy when matter moves or chemical energy when matter changes.

Gravitational energy: the energy that draws objects together. On earth most gravitational energy is due to the attraction between the earth and other objects.

Thermal energy: the energy of a body that results from the movement of molecules within the body. Recall that the movement of molecules is a measure of temperature.

Chemical energy: the energy that is due to the arrangement of atoms and molecules.

**Part 1: Class Work**

Fill in this table and take notes as we complete the first step of the analogy together in class.

|  |  |  |  |
| --- | --- | --- | --- |
| **Simple system** | **Energy Converted** | **Water cycle** | **Energy Converted** |
| Container A |  | Water Vapor in Atmosphere |  |
| Container B |  | Liquid Water in Clouds |  |
| Container C |  | Liquid Water Flowing on the Surface |  |
| Container D |  | Liquid Water Stored in a Lake |  |
| Pipe/Pump 1 |  | Evaporation |  |
| Pipe/Pump 2 |  | Condensation |  |
| Pipe 3 |  | Precipitation |  |
| Pipe 4 |  | Water Flowing |  |

**Part 2: Group Work**

Fill in Table B as in the same way we filled in Table A together, but with container A now analogous to groundwater. Identify the type of energy being converted for the simple system and the water cycle.

|  |  |  |  |
| --- | --- | --- | --- |
| **Simple system** | **Energy Converted** | **Water cycle** | **Energy Converted** |
| Container A |  | *Water Vapor* |  |
| Container B |  | *Clouds* |  |
| Container C |  | *Surface Water* |  |
| Container D |  | *Groundwater* |  |
| Container E |  | *Streams* |  |
| Container F |  | *Reservoir/Lake* |  |
| Pipe/Pump 1 |  | *Pumping water into a lake/reservoir* |  |
| Pipe/Pump 2 | *Gravitational Potential🡪 Gravitational Kinetic* | *Evaporation* | *Thermal (kinetic) energy 🡪 Chemical (kinetic) energy* |
| Pipe 3 |  | *Condensation* |  |
| Pipe 4 |  | *Precipitation* |  |
| Pipe 5 |  | *Infiltration of surface water into ground* |  |
| Pipe 6 |  | *Discharge of groundwater into streams* |  |



Table B. Aligning the system to the water cycle including groundwater.

**Group Questions**

1. If global temperatures increased, how would this change the way in which energy is utilized in the water cycle? Use the water cycle diagram below to trace how an increase in thermal kinetic energy would impact the water cycle.

B. Imagine that there was a significant decrease in thermal energy in the atmosphere. Describe how this might affect the gravitational potential of water in the atmosphere.

**Part 3: Homework**

If you complete the group work, you may work on the homework **on your own.** This means your answers should be generally unique from other students’ answers. **Submit your homework using ANGEL**.

For the following questions, decide what kind of energy transformation is happening. Your options are the kinetic and potential versions of gravitational, chemical or thermal energy. An example has been done for you:

Example. Water vapor turning into a cloud. *Chemical potential energy is transferred to thermal energy (latent heat of condensation)*

1. A dam breaking that causes a flood.
2. Driving a gasoline-powered car.
3. Burning firewood to heat water for coffee.